

## **Implementation of low-volume high-intensity interval training in UK Cardiac Rehabilitation programmes: A joint statement from the HIIT or MISS UK Research Group\* and the BACPR Exercise Professionals Group**

The British Association for Cardiovascular Prevention and Rehabilitation (BACPR) *Standards and Core Components for Cardiovascular Disease Prevention and Rehabilitation*, highlight the importance of state-of-the-art menu-based and flexible cardiac rehabilitation (CR) programmes personalised to individuals' needs and preferences, to facilitate engagement, and improve outcomes [1]. The 2019 NHS England Long-Term Plan outlined ambitions to transform care, including priorities highly relevant to CR [2]. This direction was reinforced in the *Fit for the Future: 10-Year Health Plan for England*, which outlined a system-wide vision for the delivery of care [3]. While health policy is devolved across the UK, equivalent long-term strategies in Wales, Scotland, and Northern Ireland similarly emphasise prevention, equitable access, personalised care, and the expansion of community-based rehabilitation services [4-6].

As an alternative to moderate intensity aerobic training, high-intensity interval training (HIIT) involves brief intermittent bursts of intense exercise/activity, interspersed by periods of recovery or lower intensity exercise [7]. For individuals with coronary artery disease (CAD), offering alternative approaches to exercise training supports a personalised, menu-based model of care. In a series of systematic reviews and meta-analyses, when compared to moderate intensity aerobic training, HIIT demonstrated a superior short-term effect on cardiorespiratory fitness (peak oxygen uptake;  $VO_{2\text{peak}}$ ) [8-11], and equivalent safety [12, 13]. As acknowledged in a number of international guidelines, higher-intensity exercise, delivered as part of a comprehensive CR programme, is safe and effective and often part of routine care, e.g. in France, Belgium, The Netherlands, South America and Canada [14-16], but at present, not recommended in the UK.

From 2016 to 2020, the HIIT or MISS UK trial assessed the clinical and cost-effectiveness of HIIT in UK CR programmes. This pragmatic randomised controlled trial recruited 382 individuals referred to CR with stable CAD from six outpatient centres across the UK [17]. Adopting a low-volume approach to HIIT (20-minutes; 10 x 1-minute intervals at high intensity (85-90% peak power output;  $> 85\%$   $HR_{\text{max}}$ ) interspersed with 10 x 1-minute intervals at low intensity (20-25% PPO)

or active recovery)), this trial demonstrated the clinical effectiveness of HIIT compared to moderate intensity aerobic exercise (20-60 minutes, 40-70% heart rate reserve, 11-14 (BORG RPE scale), 2-4 (CR10 scale) [18], as evidenced by a greater improvement in peak oxygen uptake ( $\dot{V}O_{2\text{peak}}$ ). Moreover, when delivered as part of a comprehensive NHS CR programme, HIIT was well-tolerated, cost-effective, and demonstrated long-term effects equivalent to moderate intensity aerobic exercise [18, 19].

In referencing the HIIT or MISS study, the 2023 Association of Chartered Physiotherapists in Cardiovascular Rehabilitation (ACPICR) *Standards for Physical Activity and Exercise in Cardiovascular Populations* suggested that future UK CR guidelines would likely recommend progressing exercise training in appropriate individuals from moderate to high intensities throughout an early (core) CR programme, with a particular emphasis on low-volume HIIT [20]. With compelling evidence to support the clinical and cost effectiveness, safety, and acceptability of low-volume HIIT [21], the BACPR Exercise Professionals Group endorses the implementation of low-volume HIIT in appropriate individuals with stable CAD attending CR in the UK, and recommends it should be routinely considered as an adjunct or alternative to moderate intensity aerobic exercise. To ensure safe and effective adoption, published practitioner guidance should be followed [22].

The BACPR provides a one-day course on implementing low-volume HIIT in UK CR programmes, covering target population, prescription from submaximal functional capacity assessments, pre-session screening, progression/regression strategies, and application across modalities e.g. cycling, treadmill, rower, circuits.

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